

Bellwork

On a piece of graph paper (that you can get from the front of the class) draw a 6X8 table like the one below

[illegible]

Agenda

Boyles Law Lab – you design the experiment!

Objective

To understand the relationship between pressure and volume mathematically and practically

What you will need...

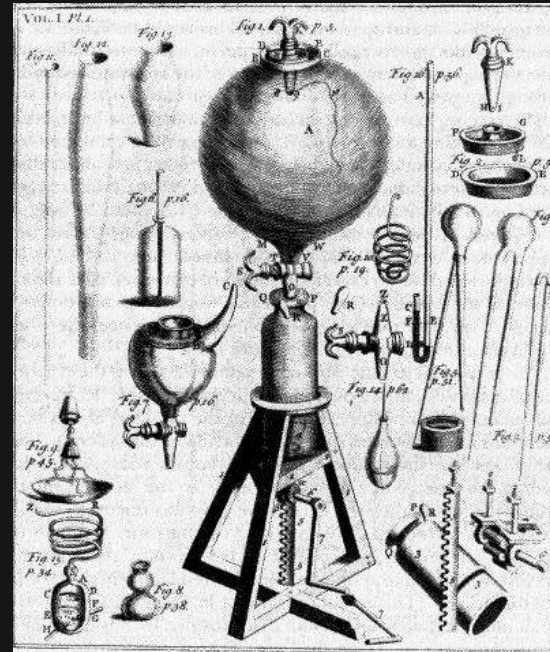
- The piece of paper with your table on it
- A blank sheet of paper to write your procedure and post lab on

Before you start collecting data

- Read over the lab with your lab group
- Devise a procedure for testing the relationship between the pressure and volume in a system
- Call me over and tell me your plan!

Boyle's Law Lab

Please do not damage the syringe



Bellwork

2/13/15

1. From the lab yesterday, what did you determine was the relationship between pressure and volume?
2. In your own words, and from your own experiences, define pressure.
3. Give two reasons why understanding the relationship between pressure and volume is important.

Agenda

Boyles Law Lab Discussion

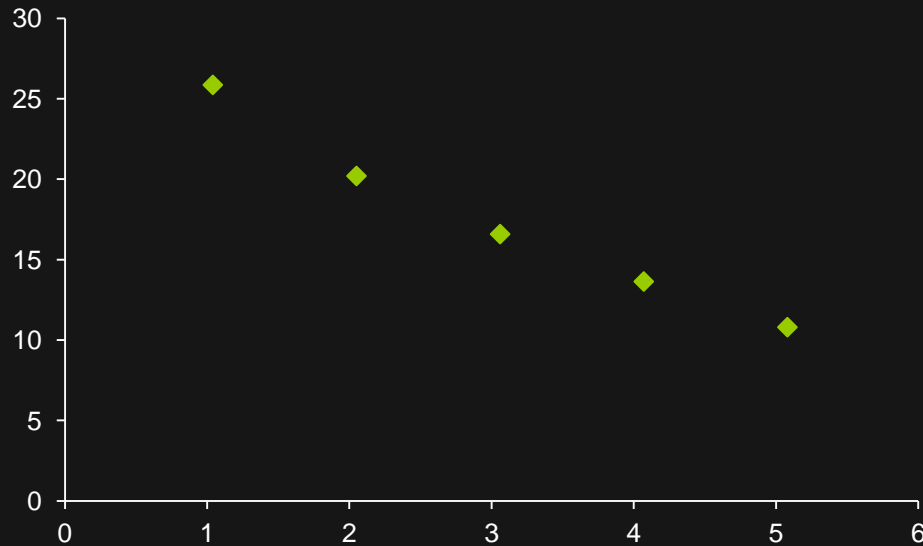
Notes on pressure

Objective

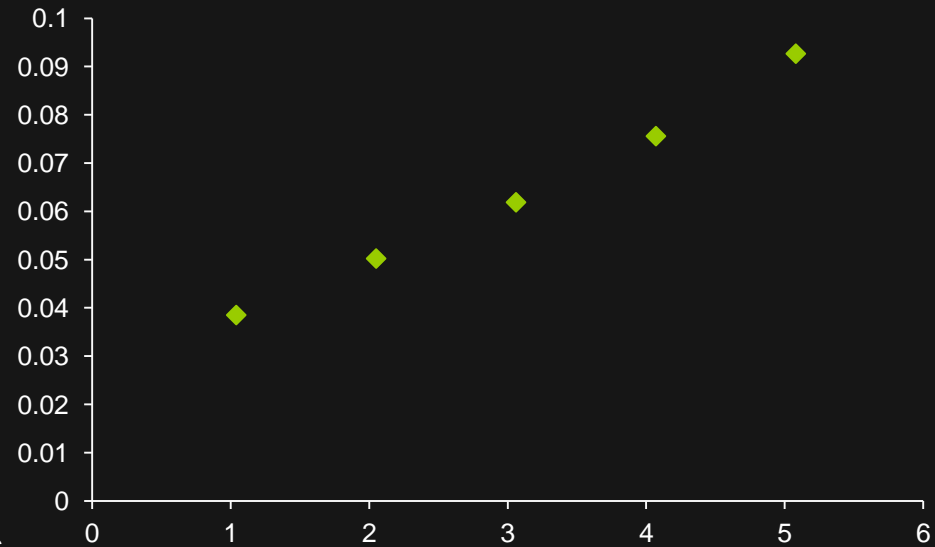
You will be able to use Boyle's Law to calculate pressure changes due to volume changes and vice versa

Boyle's Law Lab Data Analysis

Volume v. Pressure



1/Volume v. Pressure



Boyle's Law

In a system in which the amount of gas in a system stays the same and the temperature remains constant:

$$P_1 V_1 = P_2 V_2$$

P1 and P2 must be in the same units

V1 and V2 must be in the same units

What is pressure?

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

Units of Pressure

1 pascal (Pa) =

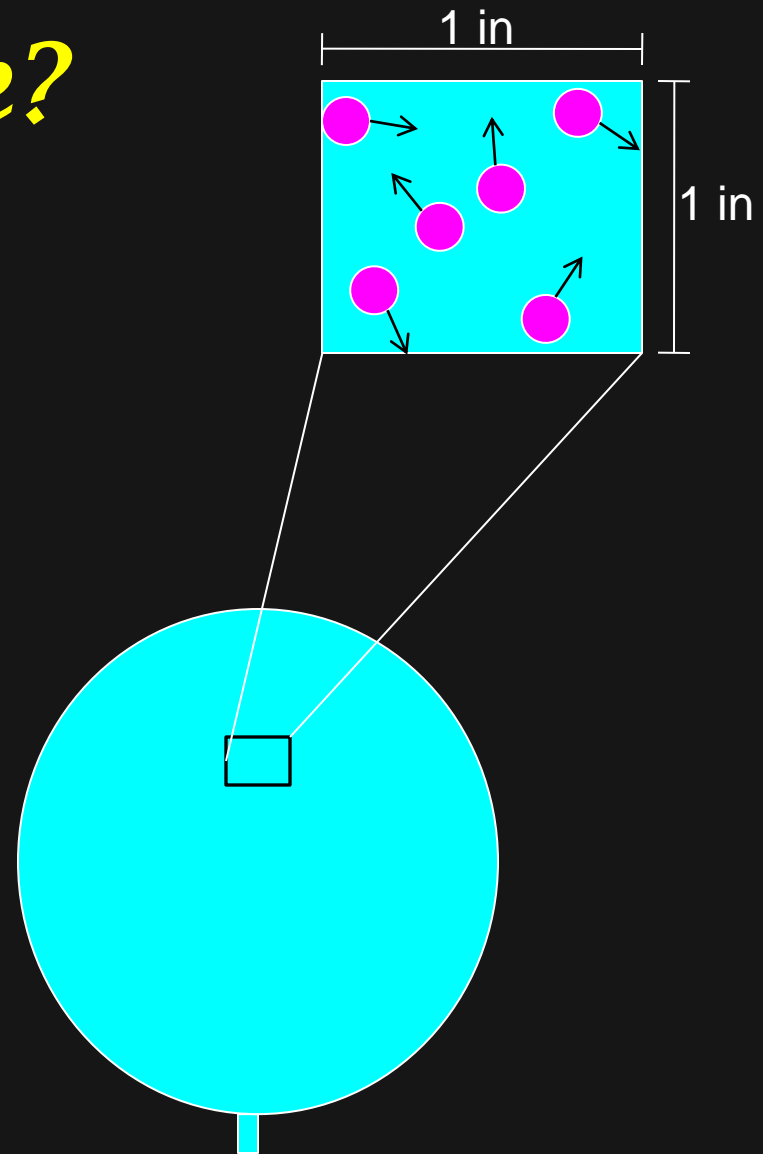
1 N/m²

1 atm =

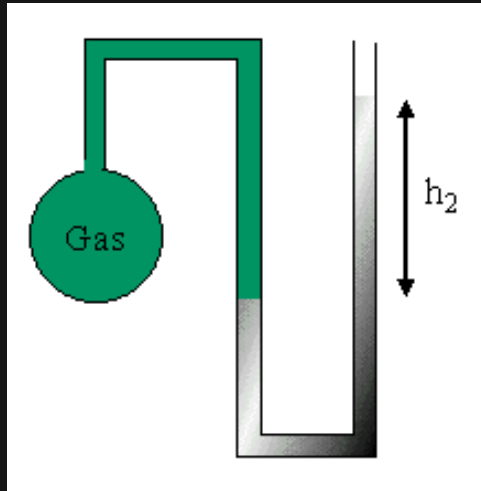
760 mmHg =

760 torr =

101.325 kPa

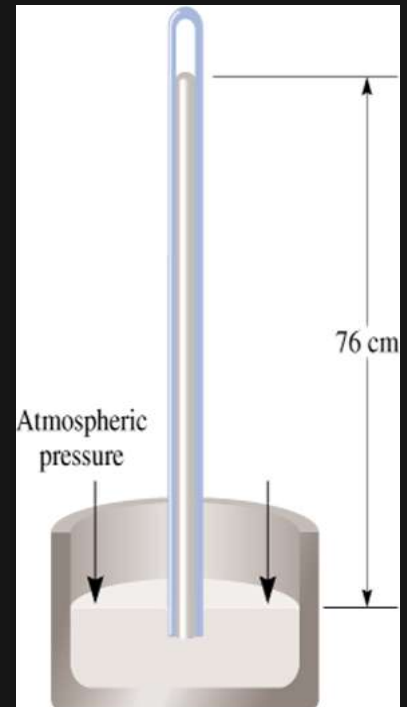


How do we measure pressure?

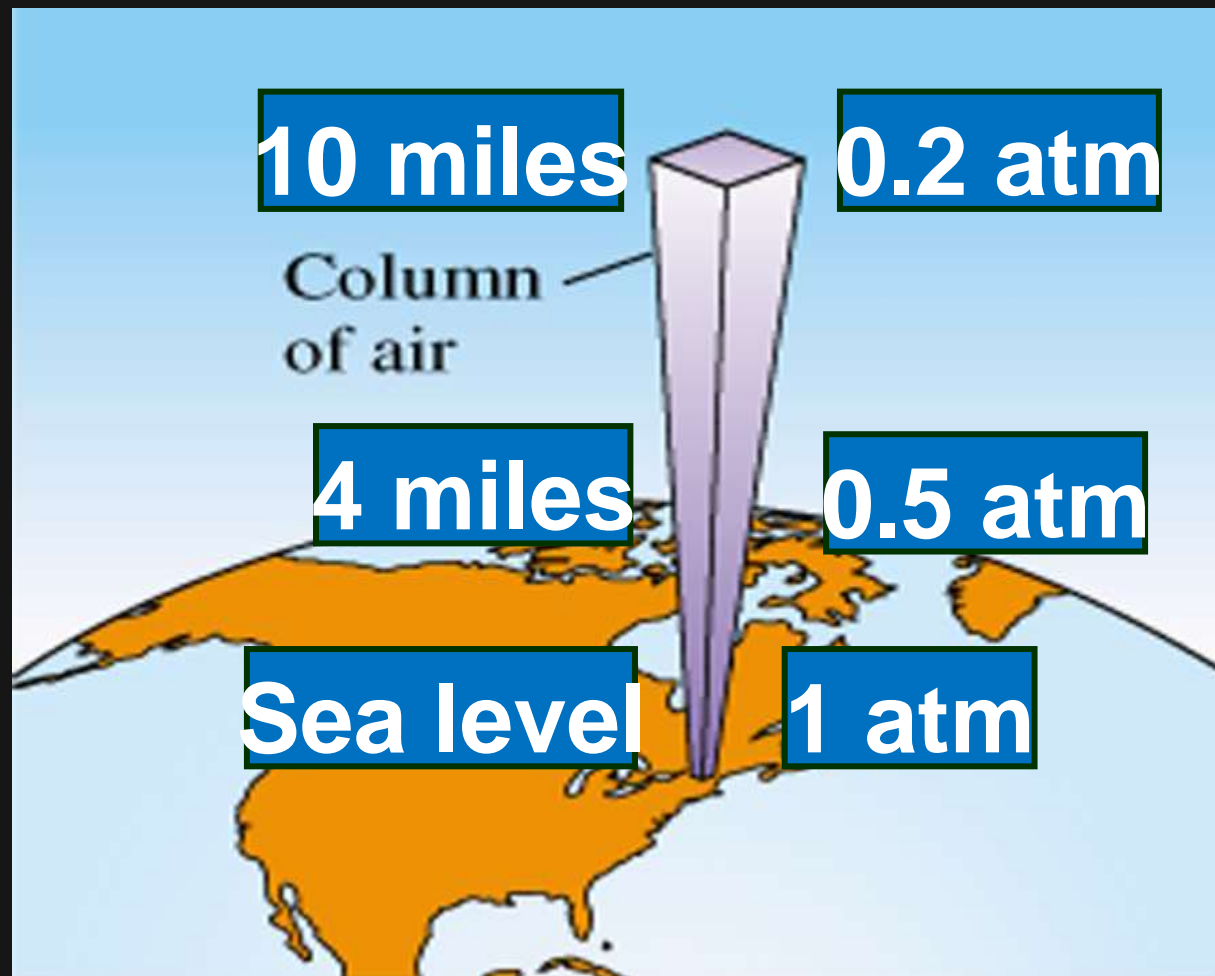


A manometer uses a U-shaped tube of liquid to measure pressure differences on either side of the liquid

A barometer uses the height of a column of mercury to measure gas pressure in mmHg



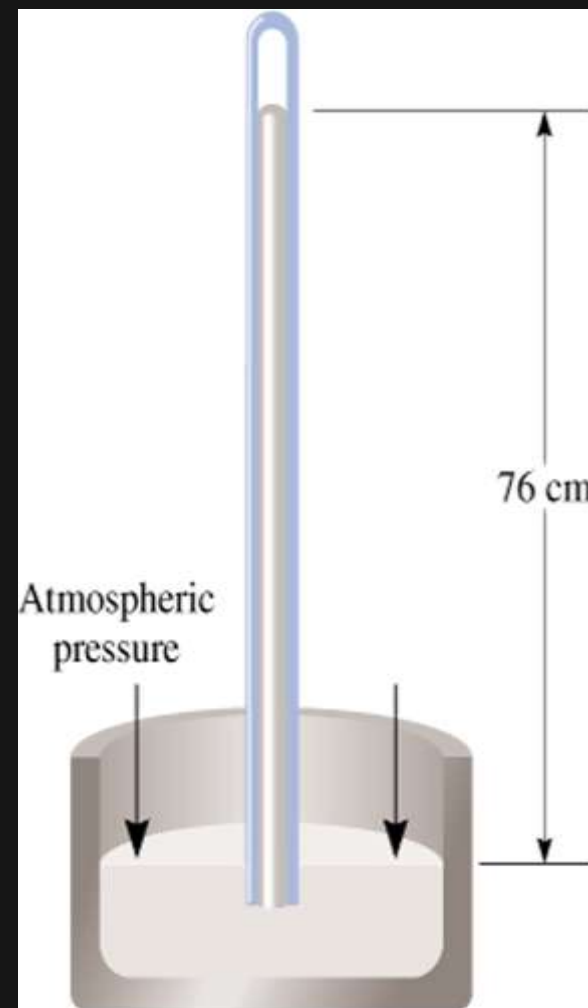
What is the pressure in mmHg at sea level?
What is the pressure in Pascals at sea level?



Try this...

Convert:

1. 727 mmHg into kPa
2. 52.5 kPa into atm
3. 0.729 atm into mmHg



Barometer

Standard Temperature and Pressure

Standard temperature and pressure (**STP**) refers to nominal conditions in the atmosphere at sea level. This value is important to physicists, chemists, engineers, pilots and navigators. Why?

Temperature = 0° C or 273K

Pressure = 1atm

Now Try This

At STP a sample of nitrogen takes up a volume of 50L. What is the new volume if the pressure is changed to 220 mmHg.

Elements that exist as gases at 25°C and 1 atmosphere

| | | | | | | | | | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1A | | | | | | | | | | | | | | | | | 8A |
| H | | | | | | | | | | | | | | | | | He |
| | 2A | | | | | | | | | | | 3A | 4A | 5A | 6A | 7A | |
| Li | Be | | | | | | | | | | | B | C | N | O | F | Ne |
| Na | Mg | 3B | 4B | 5B | 6B | 7B | 8B | | 1B | 2B | Al | Si | P | S | Cl | Ar | |
| K | Ca | Sc | Ti | V | Cr | Mn | Fe | Co | Ni | Cu | Zn | Ga | Ge | As | Se | Br | Kr |
| Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | Xe |
| Cs | Ba | La | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | Po | At | Rn |
| Fr | Ra | Ac | Rf | Db | Sg | Bh | Hs | Mt | | | | | | | | | |

Table 5.1 Some Substances Found as Gases at 1 atm and 25°C

| Elements | Compounds |
|--------------------------------------|-------------------------------------|
| H ₂ (molecular hydrogen) | HF (hydrogen fluoride) |
| N ₂ (molecular nitrogen) | HCl (hydrogen chloride) |
| O ₂ (molecular oxygen) | HBr (hydrogen bromide) |
| O ₃ (ozone) | HI (hydrogen iodide) |
| F ₂ (molecular fluorine) | CO (carbon monoxide) |
| Cl ₂ (molecular chlorine) | CO ₂ (carbon dioxide) |
| He (helium) | NH ₃ (ammonia) |
| Ne (neon) | NO (nitric oxide) |
| Ar (argon) | NO ₂ (nitrogen dioxide) |
| Kr (krypton) | N ₂ O (nitrous oxide) |
| Xe (xenon) | SO ₂ (sulfur dioxide) |
| Rn (radon) | H ₂ S (hydrogen sulfide) |
| | HCN (hydrogen cyanide)* |

* The boiling point of HCN is 26°C, but it is close enough to qualify as a gas at ordinary atmospheric conditions.